Erthwrks, Inc.
PO Box 16528
Denver, CO 80216
www.erthwrks.com

November 2, 2018

Alexis North
USEPA Region 8
1595 Wynkoop Street
Mail Code: 8ENF-AT
Denver, CO 80202-1129
north.alexis@epa.gov

Subject: SRC Energy – Vista Pad Production Facility
Weld County, CO
40 CFR Part 60 Subpart OOOOa VCU Performance Testing
Notification Variance Request

Ms. North:

On behalf of SRC Energy, Erthwrks is submitting this request for a waiver of the 30-day notification requirement for prior notification of scheduled performance tests under §60.5413a.

SRC Energy and Erthwrks would like to conduct the performance test Monday, November 19, 2018. Occasionally there are operational malfunctions due to neighboring midstream facilities, and Erthwrks would like to inform the agency that testing may occur on Tuesday, November 20, 2018.

A complete test protocol with analytical procedures is attached.

If you have any questions or if the proposed testing date is unacceptable, please contact Mr. Brad Rogers of SRC Energy at 303.229.1228, or myself at jdunn@erthwrks.com and 614.565.9177.

Regards,

Jason Dunn
Project Manager

cc: B. Rogers, SRC Energy

erthwrks

AIR EMISSIONS TESTING FOR INDUSTRY

Air Emission Test Protocol

for
SRC Energy, Inc. (SRC)

at the
Vista Pad in Weld County, Colorado

on a
1x Vapor Combustion Unit (VCU)

subject to
40 CFR Part 60 Subpart OOOOa
§60.5412a(a)(1), §60.5413a(b)

Prepared for:

SRC ENERGY

Test Date: November 19 or November 20
Erthwrks Project No. 8169

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Erthwrks, Inc. has been contracted to provide air emission testing services for SRC Energy, Inc. (SRC) at the Vista Pad located in Weld County, Colorado. Within this facility is one VCU that are used for the destruction of the vapors collected from crude storage tanks. The destruction efficiency (DE) from this unit are to be tested to determine its compliance status with regard to 40 CFR Part 60 Subpart OOOOa, §60.5413a. Air emission testing will be conducted on the VCUs for the determination of total organic compound (TOC) mass emission rates of the inlet and outlet, respectively.

TOC DE will be determined by comparing the inlet and outlet mass emission rates. For the purpose of this test program, TOC will be defined as non-methane hydrocarbons (NMHC).

Table 1: Facility Unit Information

Unit	Make	Model
VCU-1	IES	96"

1.1 Purpose of Testing

The purpose of the test is to determine the DE of the VCU system associated with the fixed-roof storage vessels. Testing will be conducted in accordance with the conditions in 40 CFR Part 60 Subpart OOOOa, §60.5413a(b).

Testing will be conducted for the determination of TOC mass emission rate and DE. Outlet oxygen (O_2) and moisture will be measured to calculate outlet flow rate and to correct TOC emissions to 3% O_2.

1.2 Description of Source

SRC Energy, Inc. (SRC) owns and operates the Vista Pad in Weld County, Colorado. This well production facility is designed to produce and store crude oil and natural gas. A mixture of crude oil, natural gas, and water is produced from each well. Within this facility each VCU, in conjunction with all components of the vapor collection system, is in place to minimize the emissions of TOCs during the production and storage of crude oil / natural gas.

The vapor combustor unit is a 96" Innovative Environmental Services (IES) VCU. The emissions from the on-site storage tanks are vented to the VCU and are burned in the combustion chamber of the VCU.

ED_004016P_00007450-00004

SRC Energy, Inc. (SRC)
Brad M. Rogers
Health and Environmental Manager
Office: 970.475.5242
Mobile: 303.229.1228
E: brogers@srcenergy.com

Erthwrks, Inc.
Jason Dunn
Project Manager
P.O. Box 16528
Denver, CO 80216
614-565-9177 office
888-573-9994 fax
jdunn@erthwrks.com

Facility Location:
Vista Pad
Location: TBD

Table 2: Test Matrix

Unit	Parameter	Citation	Applicable Limit
VCU-1	DE	§60.5412a(a)(i)	95% TOC DE
	Concentration	§60.5412a(a)(ii)	275ppm @ 3% O_2
	Temperature	§60.5412a(a)(iii)	1400°F

2.0   SAMPLING AND ANALYTICAL PROCEDURES

2.1   Description of sampling and field procedures

Erthwrks will utilize the following methods for the emission rate determination:

EPA Method 1 for sample location
EPA Method 2 for outlet flow rate
EPA Method 2D for inlet flow rate
EPA Method 3A for O_2 outlet concentration
EPA Method 4 for outlet moisture content
EPA Method 25A for TOC inlet/outlet concentration

Erthwrks, Inc. will utilize a mobile laboratory on site to conduct the emission testing. In order

to avoid conducting third-party lab analysis, both inlet and outlet sources will be tested simultaneously by the same detection principles to offer real-time DE determination.

Inlet Mass Emission Rate

Inlet TOC concentration and flow rates will be measured utilizing a calibrated thermal mass meter and an inlet sample system designed to continuously monitor the waste gas. The inlet gas will be diluted and directed toward a NMHC Flame Ionization Detector (FID). The inlet sample will be diluted in order to reduce concentrations to the range of the NMHC FID. NMHC concentrations will be displayed on the analyzer front panel in parts per million, wet volume basis as propane (ppmvw as C_3H_8) and logged to the CDAS.

The inlet flow rate determination will be conducted following all procedures and quality assurance as specified by Method 2D. A thermal mass meter will be installed on the waste gas pipe that enters the VCU. This meter will be calibrated to correctly measure crude vapor, and all manufacturer calibration and installation parameters will be followed.

Outlet Mass Emission Rate

The mass emission rate of the outlet will be calculated with a combination of Method 1, 2, 3A, 4, and 25A.

A NMHC FID will be used to directly measure outlet TOC levels. Each sampling period consisted of extracting a sample from the location at a constant flow rate of approximately four liters per minute (lpm) using a heated Teflon gas line. The gas will be directed into the separation column of the NMHC FID. NMHC concentrations will be displayed on the analyzer front panel in parts per million, wet volume basis as propane (ppmvw as C_3H_8) and logged to the CDAS.

Each sampling period consisted of conducting a differential pressure traverse of the stack using an S-type pitot tube for outlet stacks greater than 12" inside diameter or a standard pitot tube for outlet stacks less than 12", and a temperature traverse using a K-type thermocouple.

A sample of gas for moisture determination will be extracted from the EC outlet at a constant flow rate of no more than 0.75 cubic feet per minute (cfm). The gas sample will be passed through a stainless steel probe, through a series of four (4) chilled glass impingers, and through a calibrated dry gas meter. Appendix D contains a schematic of the EPA Methods 1, 2 and 4 sampling train. The H_2O content traverse will be not conducted for this test as it is assumed that the stack geometry will provide adequate gas mixing. Prior to sampling, the first two impingers were seeded with approximately 100 millimeters of water. The third impinger will be empty, and the fourth impinger contained approximately 250 grams of dried silica gel. Following sampling, the moisture gain in the impingers will be measured gravimetrically to determine the percent moisture content of the gas.

All of the above data will be combined with concurrently collected diluent data to calculate the stack gas velocity and volumetric flow rate in units of feet per second (ft/sec), actual cubic feet per minute (acfm), dry standard (1 atmosphere and 68 degrees Fahrenheit) cubic feet per minute (dscfm), and pounds per hour (lb/hr).

Example sample calculations are contained in Appendix C.

The determination of the TOC concentration followed all QAQC procedures as specified in the US EPA 40 CFR 60 Appendix A, Method 25A. The calibration error (CE) test will be conducted following the procedures specified in EPA Method 25A §8.4. In accordance with this requirement, a four-point analyzer calibration error test will be conducted prior to outlet sampling. This CE test will be conducted by introducing the zero, low, mid, and high-level calibration gasses (as defined by EPA Method 25A §7.1.2-5) and the response will be recorded. The results of the CE test are acceptable if the results for the low and mid-level calibration gasses are within ±5.0% of the predicted responses as defined by the linear curve from the zero and high-level results. The sample system response time will be recorded in accordance with EPA Method 25A §8.5.

Immediately following the completion of the test period, and, periodically during the test, the drift determination will be conducted to validate the test data in accordance with EPA Method 25A §8.6.2. The test data is valid if the calculated drift is within ±3.0% of the span value (EPA Method 25A §13.1.2).

Table 3: Analytical Instrumentation

Effluent Tested	Analyzer Make/Model	Range will utilize	Detection Principle
Inlet TOC	Thermo 55i	5,000 ppm	Flame Ionization Detector
Outlet TOC	Thermo55i	1000 ppm	Flame Ionization Detector
O_2/CO_2	Servomex 1440	25%	Paramagnetic
Mass Thermal Meter	Sierra Instruments Quadratherm 640i	70,000 SCFH	Thermal Mass

The inlet sampling site will be located in the vapor will be te stream at the mass thermal meter location. Following the procedures set forth in EPA Method 2D for flow determination, the Method 1 port and traverse point locations for the inlet sampling do not apply. The outlet sampling site will be located at the ports provided on the outlet stack. The sample probe will be positioned to sample from a central location in the stack in accordance with **EPA Method 25A §8.1-2**.

A stratification test will be not will conducted for EPA Methods 3A as stratification is not expected due to the mechanical construction of the combustion zone and the outlet stack. Conducting a representative stratification test on a unit with a constantly dynamic combustion

zone is not possible. As specified in section **US EPA Method 25A §6.1.2**, sampling of the outlet will be conducted from the centrally located 10 percent area of the stack cross-section of the stack.

Appendix A
Example Data of Detailed Results of Emission Test

	Field Reference Method Data				
	Run #	1	2	3	Average
	Start Time	11:19	12:28	13:37	
	Stop Time	12:18	13:27	14:36	
	Sample Duration (minutes)	60	60	60	
hrs	Assumed Hours of Operation / Year	8,760	8,760	8,760	8,760
D_s	Stack Diameter (inches)	85.5	85.5	85.5	85.5
$\ddot{O}DP_{AVG}$	Average (Delta P)$^{\frac{1}{2}}$ (" H_2O)$^{\frac{1}{2}}$	0.218	0.246	0.265	0.243
C_p	Pitot Tube Constant (unitless)	0.84	0.84	0.84	0.84
T_s	Stack Temperature (°F)	957	1312	1372	1214
P_{bar}	Barometric Pressure (mbar)	852	852	852	852
P_{bar}	Barometric Pressure (" Hg)	25.16	25.16	25.16	25.16
Ps	Stack Pressure (" H_2O)	0.01	0.01	0.01	0.01
F_d	F_d value (dscf/MMBtu)	8,710	8,710	8,710	8,710
F_c	F_c value (dscf/MMBtu)	1,040	1,040	1,040	1,040
O_2%vd	O_2 (%vd)	15.7	14.7	14.7	15.0
CO_2%vd	CO_2 (%vd)	3.8	4.4	4.4	4.2
N_2%vd	N_2 (%vd)	80.5	80.9	81.0	80.8
dry	NO_x (ppmvd)	33.6	46.0	45.0	41.5
dry	CO (ppmvd)	4.7	2.7	3.1	3.5
dry	TVOC (ppmvd)	21.4	15.1	14.7	17.1
	Reference Method Calculations				
	Run #	1	2	3	Average
B_{ws}	Moisture Content (%/100)	0.049	0.053	0.057	0.053
B_{ws}	Moisture Content (%)	4.9	5.3	5.7	5.3
M_D	Molecular Weight Dry (lb/lb-mole)	29.23	29.29	29.28	29.27
M_A	Molecular Weight Wet (lb/lb-mole)	28.68	28.69	28.65	28.67
V_s	Gas Velocity (ft/sec)	21.9	27.6	30.4	26.6
F_{ACFM}	Gas Flow (acfm)	52,391	66,104	72,663	63,719
F_{DSCFM}	Gas Flow (dscfm)	15,612	15,681	16,613	15,969
lb/hr	Gas Flow (lb/hr)	73,318	73,995	78,556	75,289
F_o	F_o (unitless)	1.381	1.420	1.426	1.409
Est. FC	Estimated Fuel Consumption (Btu/hr)	26,713,677	32,264,953	34,009,213	30,995,948	*Limits*
wet	O_2 (%vw)	14.9	13.9	13.9	14.2
wet	CO_2 (%vw)	3.6	4.2	4.1	3.9
	Outlet Data				
wet	NO_x (ppmvd)	31.9	43.5	42.4	39.3
lb/hr	NO_x (lb/hr)	3.75	5.16	5.35	4.75
lb/mo	Nox (lb/mo)	2790.00	3839.04	3980.40	3536.48
tpy	NO_x (tons/year)	16.43	22.60	23.43	20.82
wet	CO (ppmvd)	4.5	2.6	2.9	3.3
lb/hr	CO (lb/hr)	0.32	0.19	0.22	0.24
lb/mo	CO (lb/mo)	238.08	141.36	163.68	181.04
tpy	CO (tons/year)	1.40	0.83	0.96	1.06
lb/hr	TVOC (lb/hr)	2.29	1.62	1.67	1.86
lb/mo	TVOC (lb/mo)	1703.76	1205.28	1242.48	1383.84
tpy	TVOC (tons/year)	10.03	7.10	7.31	8.15
	Inlet Data				
lb/mo	Inlet TVOC (lb/month)	490219.45	523025.83	609469.60	540904.96
tpy	Inlet TVOC (tons/year)	2885.97	3079.10	3588.01	3184.36
%	Destruction Rate Efficiency (%)	99.65	99.77	99.80	99.74

Appendix B
Example Quality Control Documentation

Client:
Facility:
Project No:
Date:
Source:
Location:
Technicians:

Erthwrks Quality Control Documentation

Calibration Gas Verification

Pollutant	Low-Level Target Gas Conc. (C_l)	Mid-Level Target Gas Conc. (C_m)	High-Level Target Gas Conc. (C_h/CS)
Inlet NMHC	15.01	29.96	59.91
Outlet NMHC	248.2	498.2	1041.0
O_2	2.6	5.15	10.00
CO_2	2.48	5.024	9.984

Certified Bottles Serial Number

Low-Level Target Gas Conc. (C_l)	Mid-Level Target Gas Conc. (C_m)	High-Level Target Gas Conc. (C_h/CS)	Dilutor Reel Gas
EB0066947	CC433039	XC028480B	NA
CC459390	CC282638	CC125969	NA
01/00/00	CC480582	CC323274	NA
CC459390	CC480582	CC323274	NA

* Cylnder certificate serial number not shown if dilutor was used

Direct Calibration Error Test

Pollutant	Zero Gas Response (C_{0m})	Calibration Error (ACE)	Low-Level Response (C_{lm})	Calibration Error (ACE)	Mid-Level Response (C_{mm})	Calibration Error (ACE)	High-Level Response (C_{hm})	Calibration Error (ACE)
Inlet NMHC	-0.08	-0.13%	14.85	-0.64%	29.92	0.03%	59.89	-0.04%
Outlet NMHC	3.22	0.31%	254.79	1.34%	502.87	0.27%	1044.42	0.33%
O_2	0.20	2.00%	2.50	-0.80%	5.00	-1.47%	10.00	0.00%
CO_2	0.01	0.11%	2.48	-0.01%	5.04	0.17%	9.83	-1.52%

* ACE must either be within ± 5% of the respective calibration gas value for the low and mid level gases

Response Time Determination

Pollutant	Time from Span to Zero Gas(s)	Time from Zero to Span Gas(s)
Inlet NMHC	28	25
Inlet Sample	25	25
System	25	25
Average:	26.0	25.0

Pollutant	Time from Span to Zero Gas(s)	Time from Zero to Span Gas(s)
Outlet NMHC	30	30
Exhaust Sample	30	30
System	30	30
Average:	30.0	30.0

Drift Determination Raw Data--Periodic Calibration Drift Assessment Throughout Testing Period

Pollutant	Time: 10:23		Time: 11:31		Time: 13:54	
	Zero Level Sys. Response (C_{0m})	Cal Gas Sys. Response (C_{hm})	Zero Level Sys. Response (C_{0m})	Cal Gas Sys. Response (C_{hm})	Zero Level Sys. Response (C_{0m})	Cal Gas Sys. Response (C_{hm})
Inlet NMHC	-0.53	14.71	-0.20	14.74	-0.24	14.88
Outlet NMHC	1.55	249.46	5.99	252.14	12.43	258.64
O_2	0.10	2.49	0.00	2.35	-0.10	2.40
CO_2	0.01	2.46	0.02	2.48	0.02	2.51

Drift Determination Calculations

Pollutant	Time: 10:23		Time: 11:31		Time: 13:54	
	Zero Drift Assessment (D_0)	Cal Drift Assessment (D_M)	Zero Drift Assessment (D_0)	Cal Drift Assessment (D_M)	Zero Drift Assessment (D_0)	Cal Drift Assessment (D_M)
Inlet NMHC	-0.75%	-0.23%	-0.20%	-0.18%	-0.28%	0.05%
Outlet NMHC	-0.16%	-0.51%	0.27%	-0.25%	0.88%	0.37%
O_2	-1.00%	-0.10%	-2.00%	-1.50%	-3.00%	-1.00%
CO_2	0.03%	-0.22%	0.04%	-0.01%	0.04%	0.34%

* D_0 and D_M must be within ± 3.0% of the span concentration

Appendix C
Example Calculations

Erthwrks Example Calculations - VCU DRE

Example Calculations for Run 1

E_i	43.39	Mass rate of TOC at the inlet, dry basis, kilograms per hour (minus methane and ethane, if applicable)
E_o	0.75	Mass rate of TOC at the outlet, dry basis, kilograms per hour (minus methane and ethane, if applicable)
K_2	2.494E-06	Constant, 2.494×10^{-6} (parts per million) (gram-mole per standard cubic meter) (kilogram/gram) (minute/hour), where standard temperature (gram-mole per standard cubic meter) is 20 °Celsius.
C_{iw}	9069	Concentration of waste gas TOC as propane at the inlet, dry basis, parts per million by volume.
C_{if}	36276	Concentration of supplemental gas TOC as propane at the inlet, dry basis, parts per million by volume, if applicable
C_o	78.25	Concentration of TOC as propane at the outlet, dry basis, parts per million by volume.
M_p	44.1	Constant, molecular weight of propane, 44.1 gram/gram-mole
Q_{iw}	2.0	Flowrate of waste gas stream at the inlet, dry standard cubic meter per minute
Q_{if}	6.7	Flowrate of supplemental gas stream at the inlet, dry standard cubic meter per minute, if applicable
Q_o	87.16	Flowrate of gas stream at the outlet, dry standard cubic meter per minute
R_{cd}	98.27%	Control efficiency of control device, percent
C_c	127.694268	TOC concentration, as propane, corrected to 3 percent oxygen, parts per million by volume, wet basis
C_m	112	TOC concentration, as propane, (minus methane and ethane, if applicable) parts per million by volume, wet basis
$\%O_{2m}$	5.2	Concentration of oxygen, percent by volume as measured, wet basis

Mass rate of TOC to inlet of control device (kg/hr) (Ei)

$$E_i = K_2 \times (C_{iw} + C_{if}) \times M_p \times (Q_{iw} + Q_{if})$$

$$E_i = 2.494E\text{-}06 \times 8.70 \times 44.10 \times 8.70$$

$$E_i = 43.39 \text{ kg/hr}$$
or
$$E_i = 95.66 \text{ lb/hr}$$

Mass rate of TOC from outlet of control device (kg/hr) (Eo)

$$E_o = K_2 \times C_o \times M_p \times Q_o$$

$$E_o = 2.494E\text{-}06 \times 78.25 \times 44.10 \times 87.16$$

$$E_o = 0.75 \text{ kg/hr}$$
or
$$E_i = 1.65 \text{ lb/hr}$$

Control efficiency of control device (%) (R_{cd})

$$R_{cd} = \frac{E_i - E_o}{E_i} \times 100\%$$

$$R_{cd} = \frac{43.39 - 0.75}{43.39} \times 100\%$$

$$R_{cd} = 98.27\%$$

TOC concentration of control device, corrected to 3% O2, ppmv, wet basis (Cc)

$$C_c = C_m \times \frac{17.9}{20.9 - \%O_{2m}}$$

$$C_c = 112 \frac{17.9}{20.9 - 5.2}$$

$$C_c = 127.69 \text{ ppmvw @ 3\% Oxygen}$$

Erthwrks Method 1-4 Example Calculations

Dry Molecular Weight of Stack Gas, M_d

M_d = 0.440 (%CO2) + 0.320 (%O2) + 0.280 (%N2 + %CO)   *Eq. 3-1*

    Md   =   0.44 * 4.56%   + 0.32 * 14.51% + 0.28 * 80.93%

Md   =   29.31

Volume of Water Vapor Collected, $V_{wc(std)}$

$V_{wc(std)}$ = K_3 (W_f - W_i)   *Eq. 4-2*
        K_3 = 0.04715 ft3/g
        W_f = final imp weight
        W_i = initial imp weight

$V_{wc(std)}$ = 0.04715 * (3072.5 - 3039.2)

$V_{wc(std)}$ = **1.570**

Sample Gas Volume, $V_{m(std)}$

$V_{m(std)}$ = K_4 * Y * (V_m * P_m / T_m)   *Eq. 4-3*
        K_4 = 17.64 °R/"Hg
        Y = DGM calibration factor
        V_m = volume measured by DGM, dcf
        P_m = barometric pressure
        T_m = Absolute Temp at Meter (°R)

$V_{m(std)}$ = 17.644 * 0.9880 * 26.06 * 29.83 / 530.38462

$V_{m(std)}$ = **25.551**

Moisture Content, Bws

$$Bws = \frac{V_{wc(std)}}{V_{wc(std)} + V_{m(std)}}$$ *Eq. 4-4*

$$Bws = \frac{1.570}{1.570 + 25.551}$$

Bws = 0.058

Erthwrks Method 1-4 Example Calculations

Molecular Weight of Stack Gas, M_s

$M_s = M_d \, (1 - Bws) + 18.0 * Bws$ *Eq. 2-6*

   M_d = Molecular weight of stack gas, dry
          (Method 3)
   Bws = Water vapor in gas stream
          (Method 4)

M_s =   29.31 * (1 - 0.058) + 18.0 * 0.058

$\mathbf{M_s}$ =   **28.66**

Average Stack Gas Velocity, v_s

$v_s = Kp * Cp * \Delta p_{(avg)}^{1/2} * \left(\dfrac{T_{s(abs)}}{P_s * M_s} \right)^{1/2}$ *Eq. 2-7*

   Kp = 85.49 ft/sec $\dfrac{(lb/lb\text{-}mol)("H_2O)}{(°R)(inH2O)}^{1/2}$
   Cp = Pitot Coefficient, 0.84
   $T_{s(abs)}$ = Avg Stack Temp (°F) + 460
   P_s = Stack Pressure (Pbar + Pg) ("Hg)
   M_s = MW of Stack Gas (see above)

v_s =   85.49 *   0.84 *   0.0645 * (1706.5 / 29.63 / 28.66)$^{1/2}$

$\mathbf{v_s}$ =   **6.566**

Average Stack Gas Dry Volumetric Flow Rate, Q

$Q = 3600 * (1 - Bws) * v_s * A * \dfrac{(T_{std})(P_s)}{(T_{s(abs)})(P_{std})}$ *Eq. 2-8*

   T_{std} = 528 °R
   P_{std} = 29.92 "Hg

Q =   3600 (1 - 0.058) 6.566 *   89.36 * (528.0 * 29.63 / 1706.50 / 29.92)

$\mathbf{Q}$ =   **6.10E+05**

Erthwrks Quality Assurance Example Calculations

Example Calcs for Pollutant : Outlet NMHC (total organic compounds in the exhaust)

C_V (zero gas) = 0.00 = Manufacturer certified concentration of calibration gas, ppmv.
C_V (low gas) = 248.20 = Manufacturer certified concentration of calibration gas, ppmv.
C_V (mid gas) = 498.20 = Manufacturer certified concentration of calibration gas, ppmv.
C_V (high gas) = 1041.0 = Manufacturer certified concentration of calibration gas, ppmv.
C_{ss} (zero gas) = 3.22 = Measured concentration of the cal gas when measured through the sample system, ppmv.
C_{ss} (low gas) = 254.79 = Measured concentration of the cal gas when measured through the sample system, ppmv.
C_{ss} (mid gas) = 502.87 = Measured concentration of the cal gas when measured through the sample system, ppmv.
C_{ss} (high gas) = 1044.42 = Measured concentration of the cal gas when measured through the sample system, ppmv.
CS = 1044 = Calibration span (high-level gas), ppmv.
C_{S0} = 1.55 = Zero-level system response during Drift Assessment, ppmv.
C_{SC} = 249.46 = Calibration Gas system response during Drift Assessment, ppmv.

Analyzer Calibration Error (ACE) for TOC E Mid-Level Calibration Gas

$$ACE = \frac{\text{actual response for mid gas } [C_{ss} \text{ (mid gas)}] - \text{predicted value for mid gas } [Css \text{ (pred)}]}{\text{manufacturer certified concentration for mid gas } [C_V \text{ (mid gas)}]} \times 100$$

$$C_{ss} \text{ (pred)} = \frac{C_{ss} \text{ (high level)} - C_{ss} \text{ (zero gas)}}{C_v \text{ (high level)} - C_v \text{ (zero gas)}} \times C_v \text{ (mid level)} + C_{ss} \text{ (zero gas)}$$

$$C_{ss} \text{ (pred)} = \frac{1044.42 - 3.22}{1041.00 - 0.00} \times 498.20 + 3.22$$

$$C_{ss} \text{ (pred)} = 501.52$$

$$ACE = \frac{502.87 - 501.52}{498.20} \times 100$$

$$\mathbf{ACE = 0.27\%}$$

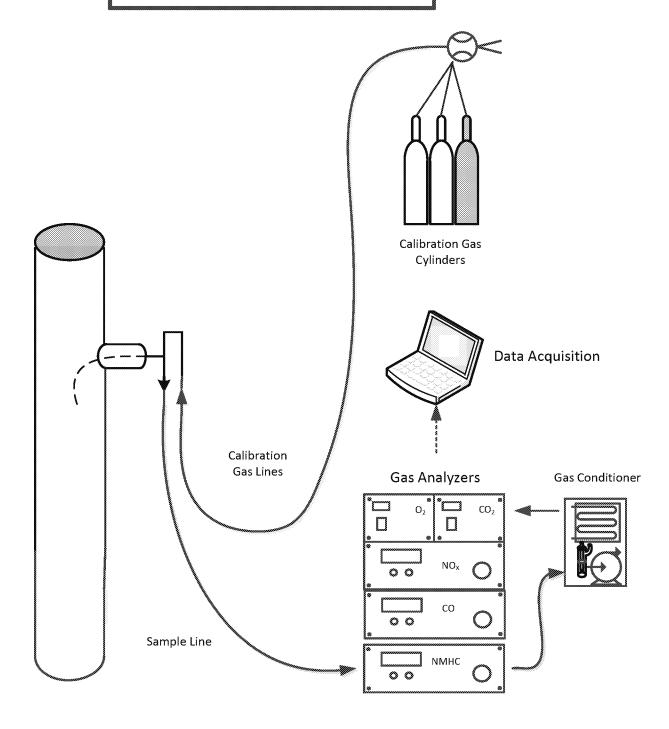## Drift Determination for Calibration Drift Assessment (D_M)

$$D_M = \frac{\text{Cal. Gas System Response (Csc)} - \text{Sample Sys Initial Calibration (Css)}}{\text{Calibration Span Value (SC)}} \times 100$$
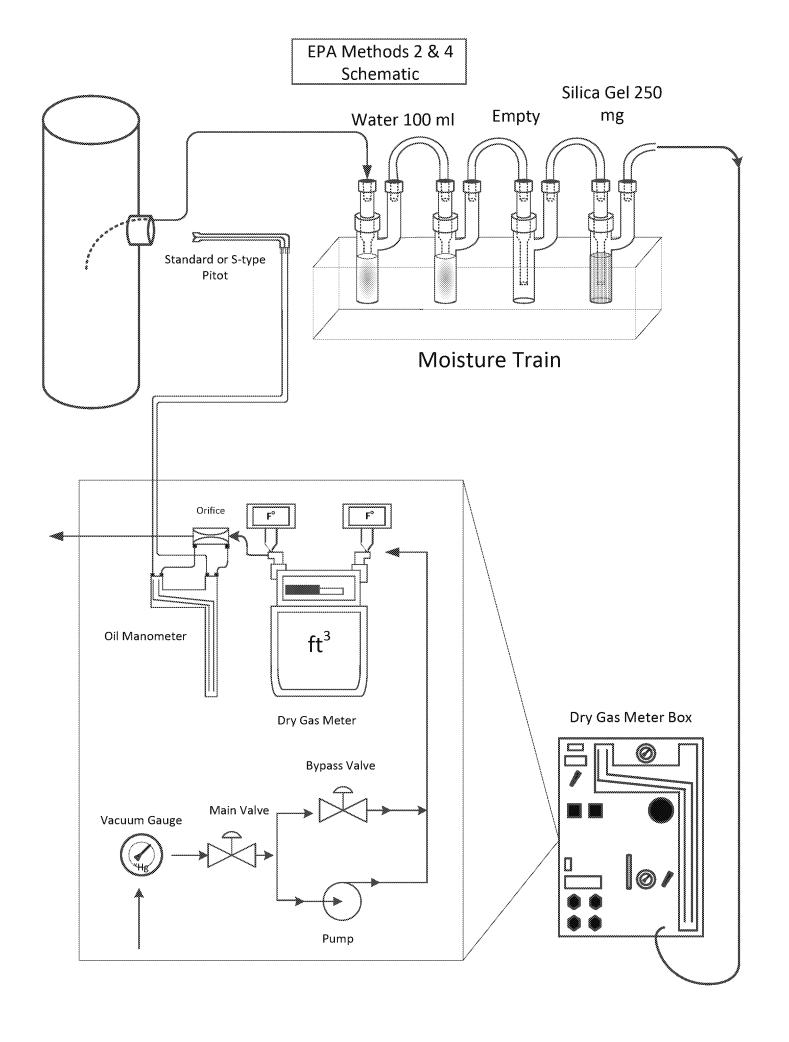
$$D_M = \frac{249.46 - 254.79}{1041.00} \times 100$$

$$\mathbf{D_M = -0.51\%}$$

Appendix D
Sample System Diagram

EPA Methods 3A, 7E, 10, & 25A
Schematic

Calibration Gas
Cylinders

Data Acquisition

Calibration
Gas Lines

Gas Analyzers

Gas Conditioner

O_2

CO_2

NO_X

CO

NMHC

Sample Line

EPA Methods 2 & 4
Schematic

Water 100 ml   Empty   Silica Gel 250 mg

Standard or S-type Pitot

Moisture Train

Orifice

F°   F°

Oil Manometer

ft³

Dry Gas Meter

Dry Gas Meter Box

Bypass Valve

Vacuum Gauge   Main Valve

"Hg

Pump

§60.18

FLARE FLOW MEASUREMENT

APPROVALS

All approvals are maintained and controlled in the Erthwrks Data Management system.
Please refer to the Erthwrks Data Management system for the current controlled revision and approval records.

REVISION HISTORY

AUTHOR	REVISED SECTION/PARAGRAPH	REV	RELEASED
[Jason Dunn]	[Initial Release]	[01]	See Erthwrks Data Management System

Draft and Archived/Obsolete revisions are not to be used.
Access Erthwrks Data Management system to verify revision.
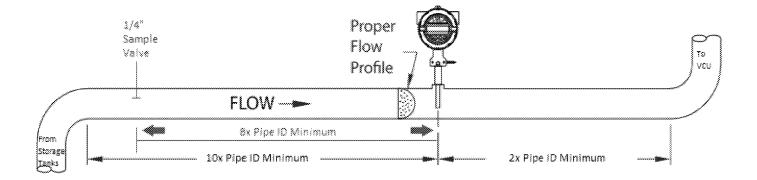
Purpose: This document is to assist operators in the correct installation of flow meters to be used in Flare testing.

Applicability: This document is applicable to various types of flow measurements devices. This procedure also satisfies the requirements of ALT-073.

Requirements:

- The flow meter initial calibration and post-test calibration check must adhere to USEPA Method 2, 2A, 2C, or 2D of 40 CFR Part 60 Appendix A-2, as appropriate (§60.5413a(b)(2)).
- The flow meter must be installed a minimum of 8 pipe inside diameters (ID) downstream of any flow disturbance, and 2 pipe ID upstream of any flow disturbance.
- The sample valve will be used to analyze the inlet gas stream. It must be installed a minimum of 8 pipe ID upstream of any flow disturbance (the flow meter).
- The sample valve must also be installed a minimum of 2 pipe ID downstream of any flow disturbance (preferably 8x ID, but 2x ID will work).
- The port for the flow meter must be a minimum of ¾" wide. Erthwrks' flow meter probe is ¾" wide, and will have a ¾" compression fitting to attach to either a port, or a valve. *The operator must provide a ¾" or 1" female compression or female NPT connection on the waste gas.*
- The port for the sample Erthwrks will take bag or can samples of the gas with the sample valve. *The operator must provide a ¼" female compression or female NPT connection on the waste gas.*

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